to 8° below zero, a thermometer on the surface of the snow, in the shade, indicated 7.5° below zero; at the same time one 6 inches below the surface read 14° above zero; and one 10 inches below the surface and touching the ground read 31°, the same as the evening before.

On the morning of the 11th, when the average temperature of the air had been 2° below zero for the preceding twenty-four hours, a temperature of 27° was registered by a thermometer 10 inches below the surface of the snow and in contact with the ground. This was the lowest temperature observed in the layer of snow immediately touching the soil.

Observations were made also in a spot of several square yards in extent from which the snow had been blown till it measured but 6 inches in depth. The temperature of the snow in contact with the ground was found to range from 31.5° to 27°. The snow in this place was exposed to the sun throughout the day.

On the 14th, observations were made in snow 25 inches deep, the depth of the snow having been greatly increased by the storm of the 11–13th. The results were the same as had been previously found so far as regards the temperature of the snow immediately on the surface of the ground.

It was noticed in all our observations that the temperature of the snow layer immediately touching the ground was fairly uniform, being on the average 31°. During the period covered by our observations the extreme range of temperature of the snow layer in contact with the ground was but 5°, while that of the atmosphere was 37°. The greatest difference observed between the atmospheric temperature and that of the snow near the ground was 38.5°, on the morning of the 10th, the temperature of the air being 7.5° below zero, and that of the snow layer touching the ground 31° above zero.

The observations made in snow upon which the sun had shone for some hours showed that the temperature of the superficial layer of the snow was considerably influenced by direct solar radiation.

The most striking fact developed in our observations was the relatively high and uniform temperature observed at the surface of the ground. This was due undoubtedly to the barrier to radiation interposed by the snow mantle. From the 5th to 14th, inclusive, the average temperature of the air was 13°, and the average temperature of the snow covered soil was certainly not below 31°. In other words, notwithstanding the fact that the temperature of the air was for 240 hours 18° lower than that of the soil, yet the latter apparently lost none of its heat. That the surface soil actually lost heat there can be no doubt, but the loss was gradual and no more rapid than the rate of conduction upward from the warmer underlying layers of earth.

The practical benefits resulting from these two snow storms, storms in which few perhaps saw any good, may now be mentioned. Had the severe cold that came with and stayed after the snows occurred without snow, or without a snow covered ground, the temperature of the soil would have fallen many degrees below freezing, and the damage to vegetation resulting from the freezing of the roots would have been enormous. But wherever the ground was covered by snow no such damage was done.

The observations are shown in detail in the table.

OBSERVATIONS AT HONOLULU.

Through the kind cooperation of Mr. Curtis J. Lyons, Meteorologist to the Government Survey, the monthly report of meteorological conditions at Honolulu is now made nearly in accordance with the new form, No. 1040, and the arrangement of the columns, therefore, differs from those previously published.

Meteorological observations at Honolulu.

FEBRUARY, 1899.

The station is at 21° 18′ N., 157° 50′ W.; altitude 50 feet.
Pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.
The average direction and maximum force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, connected by a dash, indicate change from one to the other.
The rainfall for twenty-four hours is now given as measured at 1 p. m. Greenwich time on the respective dates.
The rain gauge, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 50 feet above sea level.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m., Greenwich time, or 2:30 a. m., Honolulu time, of the respective dates.									
				Temperature.		Means.		Wind.		Total rainfall.	Average cloudiness.	Sea-level pressures.	
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Maximum force.			Maximum.	Minimum.
	*	†	†			‡	‡		§				
1	29.83	64	63.5	78	62	63.3	76	nne.	3	0.00	5-2	29.99	29.88
2	29.76	63	62	78	62	64.5	82	nne-w.	1	0.00	6	29.85	29.74
3	29.82	64	62	77	62	64.5	84	sw.	1	0.02	3-6	29.85	29.76
4	29.82	66	64	78	62	63.5	81	sw-w.	1	0.00	1-3	29.88	29.78
5	29.85	69	66.5	79	63	65.5	79	sw-w.	2	0.00	2-7	29.88	29.82
6	29.92	70	69	79	68	66.3	78	sw.	3-1	0.01	5-2	29.93	29.86
7	29.91	69	67	80	69	69.0	86	sw.	3-1	2.33	8-10	29.97	29.90
8	29.94	68	67	73	68	67.5	92	sw-w.	2-0	1.07	10	29.98	29.91
9	29.99	67	66.5	78	67	68.5	87	sw.	2-0	0.00	3-8	29.99	29.92
10	30.06	64	63	78	67	67.7	90	sw-s.	1-0	0.02	2	30.05	30.00
11	30.04	63	62.5	80	63	64.0	69	s-e.	1	0.00	1	30.10	30.00
12	30.00	64	63	81	62	64.7	80	se-ne.	2-0	0.00	1-3	30.06	29.99
13	30.01	69	64	79	63	64.0	81	sw-nw.	2	0.01	3-7	30.04	29.97
14	30.00	68	64	78	63	63.7	71	ne-s.	2-0	0.00	5	30.07	29.98
15	30.03	67	65	80	67	64.0	74	sw.	1	0.00	5	30.07	30.01
16	30.01	69	67.5	80	64	66.0	81	s.	1	0.06	5	30.09	30.00
17	30.01	65	64	80	65	67.5	84	ne-sw.	1-0	0.00	6-1	30.06	29.97
18	30.00	72	64	79	64	63.5	76	s-ne.	1	0.00	5	30.04	29.96
19	29.97	72	67	78	71	60.7	64	ne.	3	0.05	6	30.03	29.96
20	29.99	72	65	79	70	63.0	68	ne.	3-0	0.00	4	30.04	29.96
21	29.99	72	65.5	80	66	63.0	66	ne.	2	0.01	3-6	30.03	29.96
22	29.97	71	64.5	78	71	61.7	67	ne.	3-4	0.03	4	30.03	29.95
23	29.94	71	65	77	69	62.0	68	ne.	3-4	0.08	2-6	30.00	29.90
24	29.95	71	66	76	69	63.3	73	ne.	4	0.04	5-8	29.99	29.91
25	30.01	72	67	80	68	64.0	70	ne.	3-0	0.09	7	30.01	29.96
26	30.07	72	66	79	68	64.5	70	ne.	3-5	0.01	5	30.09	30.01
27	30.05	69	66	78	71	61.5	64	ne.	4-6	0.15	8	30.10	30.01
28	30.05	71	65	77	68	63.3	76	ne.	5-6	0.03	9-6	30.10	30.01
Sums.	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.01	.....	.....	.....
Means.	29.961	68.4	65.0	77.0	66.1	64.4	76.3	.....	‖	....	¶	30.012	29.931
Departure.	—0.01	.....	.....	.....	.....	+2.2	+0.3	.....	.....	—1.00	.....	.....	.....

Mean temperature for February, 1899 (6+2+9)÷3=71.9°; normal is 70.3°. Mean pressure for February is 29.96; normal is 29.97.
*This pressure is as recorded at 1 p. m., Greenwich time. †These temperatures are observed at 6 a. m., local, or 4:30 p. m., Greenwich time. ‡These values are the means of (6+9+2+9)÷4. §Beaufort scale. ‖Mean for the daytime is 1.0. ¶The mean during daylight is 4.4.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined list of titles has been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

Annales Agronomiques, Paris, Tome 25.

Pagnoul. Influence des pluies et de la nature des terres sur le rendement des fourages. P. 83.

Scottish Geographical Magazine, Edinburgh, Vol. 15.

Taylor, W. A. Meteorology of Mount Etna. [Abstract from Ciel et Terre.] P. 147.

Nature, London, Vol. 59.

Arcimis, A. Probable Weather Conditions in Spain, during the Total Solar Eclipse of May 28, 1900. P. 439.

MacDowall, A. B. American and English Winters. P. 416.

Bulletin of the American Geographical Society, Vol. 31.
Whymper, E. A New Mountain Aneroid Barometer. P. 75.
La Nature, Paris, 27me. Année.
Plumandon. J. R. Les extrêmes de température dans le monde. P. 226.
Das Wetter, Berlin, Jan. 1899.
Arendt, Theodor. Ueber die Zunahme der Blitzgefahr. [Concluded.] p. 32.
Annalen der Physik und Chemie. Leipzig. Band 67.
Mannesmann, O. Luftwiderstandsmessungen mit einen neuen Rotationsapparat. P. 105.
Comptes Rendus, Paris, Tome 128.
Deherain, P. P. Le travail du sol. P. 474.
Pallodine, W. Influence de la lumière sur la formation des substances azotes vivantes dans les tissues des végétaux. P. 377.
Philosophical Magazine, London, Vol. 147.
Raleigh, *Lord.*—Cooling of Air by Radiation and Conduction, and the Propagation of Sound. P. 308.
Ciel et Terre, Bruxelles, 19me. année.
Spring, W. Sur l'origine de la couleur bleue du ciel. P. 587.
Roquiny-Adanson, G. de. Les orages en janvier dans le centre de la France. P. 599.
Ciel et Terre, Bruxelles, 20me année.
St. Hepites. Climatologie du littoral roumain de la mer Noire. P. 1.
———Consommation d'eau par les arbres. [From Die Natur.] P. 23.
Meteorologische Zeitschrift, Wien, Band 16.
Bornstein, R. Böenstudien gelegentlich des Gewitters vom 22 Juni 1898. P. 1.
Kohlbrugge, J. H. F. Meteorologische Beobachtungen zu Tosari. (Java.) P. 5.
Laska, W. Ueber die Form der Hagelwolken. P. 22.
Hann, J. Klima von Lima. P. 32.
Zeitschrift für Luftschiffhart. Berlin. 17 *Jahrg.*
Platte, A. Zur Theorie der Luftschiffahrt mit theilweiser Entlastung. P. 245.
Berson, A. In den Fusstappen Glascher. P. 255.
Annuaire de la Société Météorologique de France, 46 *année.*
Lobat. Température de la mer. P. 72.
Scottish Geographical Magazine. Edinburg. Vol. 15.
Taylor, W. A. Egyptian Sudan. [Climate, etc.] P. 57.
Symons Meteorological Magazine. London. Vol. 34.
Symons, G. J. Frost and anticyclones. P. 6.
Dansey, R. P. Temperature reversal [case of]. P. 8.
Journal of the Franklin Institute. Philadelphia. Vol. 147.
Griffith, C. E. Anthracite Coal in Peru. [Contains account of Climate of Peru.] P. 227.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Mariano Bárcena, Director, and Señor José Zendejas, vice-director, of the Central Meteorologico-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the *Boletin Mensual;* an abstract translated into English measures is here given in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for February, 1899.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inch.*	°*F.*	°*F.*	°*F.*	%	*Inch.*		
Colima	1,656	28.30	86.9	49.3	70.0	58	.....	wsw.	sw.
Durango (Seminario)	6,243	24.39	80.6	26.6	54.9	34	.....	sw.	e.
Jalapa (1)	4,593	25.56	78.8	46.4	58.3	66	8.09	nw.	.....
Leon (Guanajuato)	5,934	24.28	74.4	30.4	57.6	34	.....	sw.	sw.
Magdalena (Sonora)	2,618	.....	.....	....	58.5	.....	0.91	s.	n.
Mexico (Obs. Cent.)	7,472	23.04	74.7	40.1	56.8	48	0.13	ne.	nw., sw.
Morelia (Seminario)	6,401	23.96	77.9	40.5	59.9	55	.....	sw.	sw.
Oaxaca	5,184	25.06	87.4	35.2	66.7	55	.....	se.	sw.
Puebla (Col. Cat.)	7,113	23.84	74.3	34.0	59.2	62	.....	sse.	.....
San Isidro	.....	.....	82.4	51.8	.....	.....	.....	w.	.....
Tuxpan (Vera Cruz)	19	30.00	98.2	29.8	67.3	79	2.66	nw., ne.	n.
Zapotlan (Seminario)	5,078	25.16	80.1	40.5	63.5	65	.....	sse.	wsw.

(1) The altitude of Jalapa differs from that formerly given, i. e., 4,757 feet, by 50 meters.

WAVE OR BILLOW CLOUDS.

ALFRED J. HENRY, Chief of Division.

A remarkably perfect type of wave or billow clouds, parallel bands or ridges, separated by a small space of clear sky, as a furrow separates the rows of grain in a field, was seen at Washington, D. C., at 8 a. m. November 23, 1898.

Plates I, II, III and IV have been reproduced from photographs made by the writer at 8:25, 8:30, 9:35 and 9:40 a. m., seventy-fifth meridian time, respectively. Plate I is a transverse view of the clouds as they approached from the southwest. The photograph from which the illustration was reproduced was made on the roof of the Weather Bureau building in Washington, D. C.

Plate II is a longitudinal view of the same clouds made in the same position but looking eastward, the camera being turned through an angle of about 90°.

Plates III and IV are views made about an hour later, viz, at 9:35 and 9:40 a. m. The position of the camera in the last-named views was not quite the same as those made earlier in the day, as may be seen by the horizon line.

The clouds were probably in the alto-cumulus level, possibly a little lower, and their apparent motion was rather rapid. The direction of the parallel bands, when first observed, was approximately east and west. Later it seemed to change slightly, taking a direction, say from north 80° west to south 80° east. The degradation of the clouds began about 9 o'clock; an hour later the last vestige had disappeared, although the sky was almost half covered with cirrus and cirro-stratus. The last named appear in Plate III and less distinctly in Plate IV.

In the lower left-hand corner of Plate II small, detached clouds may be seen. While looking at this portion of the sky at 9 a. m., a remarkably distinct file of five or six small clouds was observed in the rear of a larger cloud mass. In a moment a small cloud became visible directly in the rear of the file above referred to. It seemed to remain motionless for a few seconds, increasing in size meanwhile, and finally moving forward in the line of march, and this process was repeated until there were 12 small clouds moving forward in column formation where there had been but 5 or 6 originally. The clouds now began to decrease in size, and the formation of new clouds ceased.

The general weather conditions at the surface of the ground, as shown by the morning weather map of the 23d were as follows: An area of high pressure with cold, northwesterly winds was approaching from the west. Pressure was relatively low off the Carolina coast, 29.94 at Hatteras. It was snowing in western Pennsylvania and raining in the eastern part of the state as also in New Jersey. The rain had ceased at Washington, the wind having shifted from southeast to northwest at 9:30 p. m. of the 22d; the temperature at that hour was about 53°; it began to fall soon thereafter and continued falling during the night, reaching a minimum of 34°, from which point it had risen to 36° at the time the first photograph was made. The wind was blowing steadily from the northwest at a velocity of 12 miles per hour. Pressure was 30.10 inches, having risen 0.18 inch during the last twenty-four hours.

Plates V and VI show a somewhat similar cloud formation on January 27, 1899.

The clouds were moving toward the northeast, as in the case first mentioned. The weather conditions were also similar in many respects. An area of high pressure and lower temperature was approaching from the west. The storm, central the preceding morning in upper Michigan, had moved rapidly to the Gulf of St. Lawrence, accompanied by violent westerly gales on the lower Lakes. High northerly winds